TECHNICAL MEMORANDUM

LANDAU ASSOCIATES
ENVIRONMENTAL | GEOTECHNICAL | NATURAL RESOURCES

TO: Carl Bach

FROM: Kris Hendrickson, P.E., and Mario Lopez

DATE: November 14, 2007

RE: **STORMWATER SYSTEM LINE REPLACEMENT**
NORTH BOEING FIELD
JUNE TO SEPTEMBER 2007

This document presents the results of the soil sampling investigation conducted by Landau Associates during the replacement and/or re-routing of three sections of the north stormwater system line between the northeast corner of Building 3-326 and Manhole 173 (MH-173) at North Boeing Field (NBF) in Seattle, Washington. The stormwater system line is located adjacent to the King County Airport and the City of Seattle Georgetown Steam Plant (Figures 1 and 2). The purpose of this investigation was to further characterize the extent of polychlorinated biphenyls (PCBs) in soil adjacent to the northern portion of the stormwater system at NBF. The investigation was conducted in general accordance with the work plan (Landau Associates 2007) and included collecting and submitting soil samples for laboratory analysis and documenting the analysis results.

SOIL SAMPLING ACTIVITIES

The stormwater system line replacement was conducted in three phases. The first phase involved partial removal and abandoning in place of existing stormwater system piping and installing new piping between catch basin CB-187 and manhole MH-181. OWS-186 was abandoned in place and filled with concrete grout. Two new catch basins were installed: CB-187A downstream of CB-187 and CB-182A between CB-182 and MH-181. During this first phase of stormwater system line replacement, 22 soil samples (NBF-1 through NBF-11) were collected from 11 locations along the new stormwater system line trench. Soil sample locations are shown on Figure 3. Sampling for the first phase was completed on June 19, 2007.

The second phase of the stormwater system line replacement involved the removal and installation of approximately 50 ft of the stormwater system line east and upstream from the new catch basin CB-187A. Two new catch basins were installed: CB-188B was installed just off the northwest corner of the 3-326 building and CB-188A was installed at the junction between CB-188 and the roof drain line that flows into CB-188B. Eight soil samples (NBF-12 through NBF-15) were collected from

four locations along the stormline trench. Soil sample locations are shown on Figure 3. Sampling for the second phase was completed on July 10, 2007.

The third phase of the stormline system replacement involved abandoning and replacing portions of the stormwater system between MH-179A and CB-173, and between CB-174 and CB-173. During this phase of the repairs, catch basin CB-175 was removed and replaced. A new manhole (MH-179B) was also placed in this portion of the run. Six soil samples (NBF-GB1 through NBF-GB6) and two water samples (NBF-GW01 and NBF-GW02) were collected along the trench. Soil and water locations are shown on Figure 4. Sampling for the third phase was completed on July 12, 2007.

During Phases 1 and 2, soil samples were collected from two depth intervals: one from 1 to 2 ft below ground surface (BGS) and one from the deepest 1-ft interval of the excavation trench. During Phase 3, samples were collected from a 1-ft depth interval just below each removed pipe. Soil samples were collected directly from the sidewall of the excavation trenches using clean disposable spoons. Each sampling location was scraped with a spoon to expose fresh soil. The soil was then homogenized in a decontaminated stainless-steel bowl and placed directly into 8 oz. laboratory-supplied sampling containers. In addition, two water samples were collected from the excavation trench near CB-175 during Phase 3. Upon completion of the pipe replacements, all trenches were backfilled with clean gravel, compacted, and re-paved. All excavated soil was placed in roll-off boxes for disposal by Boeing. During the excavation activities, water from de-watering was collected in vacuum trucks and placed in large capacity Baker tanks for onsite treatment by Boeing.

The soil and water samples were delivered to Analytical Resources, Inc. (ARI) for analysis of PCBs using U.S. Environmental Protection Agency (EPA) Method 8082. Two of the soil samples and the water samples were also analyzed for total petroleum hydrocarbons using methods NWTPH-D and NWTPH-G.

INVESTIGATION RESULTS

Soil was visually screened throughout the trench sections for evidence of petroleum contamination. A slight sheen was visible on the water surface in the trench excavation in most areas, and several areas of the excavation sidewall exhibited visual signs of contamination in the soil, including the area at sample location NBF-2 where a dark brown to black material with a sheen and a slight odor was present mixed with the soil; the area north of sample location NBF-7 and at sample location NBF-8 where a thick, black tar-like material, bricks, concrete debris and asphalt pieces were present; and near sample location NBF-11, where an approximately 6-inch thick black layer was visible in the east sidewall for a distance of 3.5 to 4 ft.

The analytical results for the soil samples are presented in Table 1. Soil sample locations and total PCB concentrations are presented on Figures 3 and 4. PCBs were detected in 28 of the 36 samples collected. The highest concentrations were found adjacent to the City of Seattle Georgetown Steam Plant property at sample locations NBF-2 (2.75 to 3.75 ft BGS); NBF-8 (1 to 2 ft BGS); NBF-13 (both sample intervals); and NBF-15 (3 to 4 ft BGS). PCB concentrations in samples NBF-8 (1 to 2 ft BGS) and NBF-15 (3 to 4 ft BGS) exceeded 1,000 mg/kg (1,100 mg/kg and 2,680 mg/kg, respectively). The two soil samples analyzed for petroleum hydrocarbons contained detectable concentrations of diesel-range and motor oil-range petroleum hydrocarbons; one of the two samples (NBF-GB05) also contained gasoline-range petroleum hydrocarbons. All petroleum hydrocarbon concentrations were less than Model Toxics Control Act (MTCA) Method A soil cleanup levels.

The analytical results for the two water samples are presented in Table 2. These two water samples were collected because an apparent sheen was observed on water in the excavation near manhole MH-173. PCBs were detected only in sample NBF-GW01 at a concentration of 1.9 µg/L. Petroleum hydrocarbons were not detected in either sample.

USE OF THIS TECHNICAL MEMORANDUM

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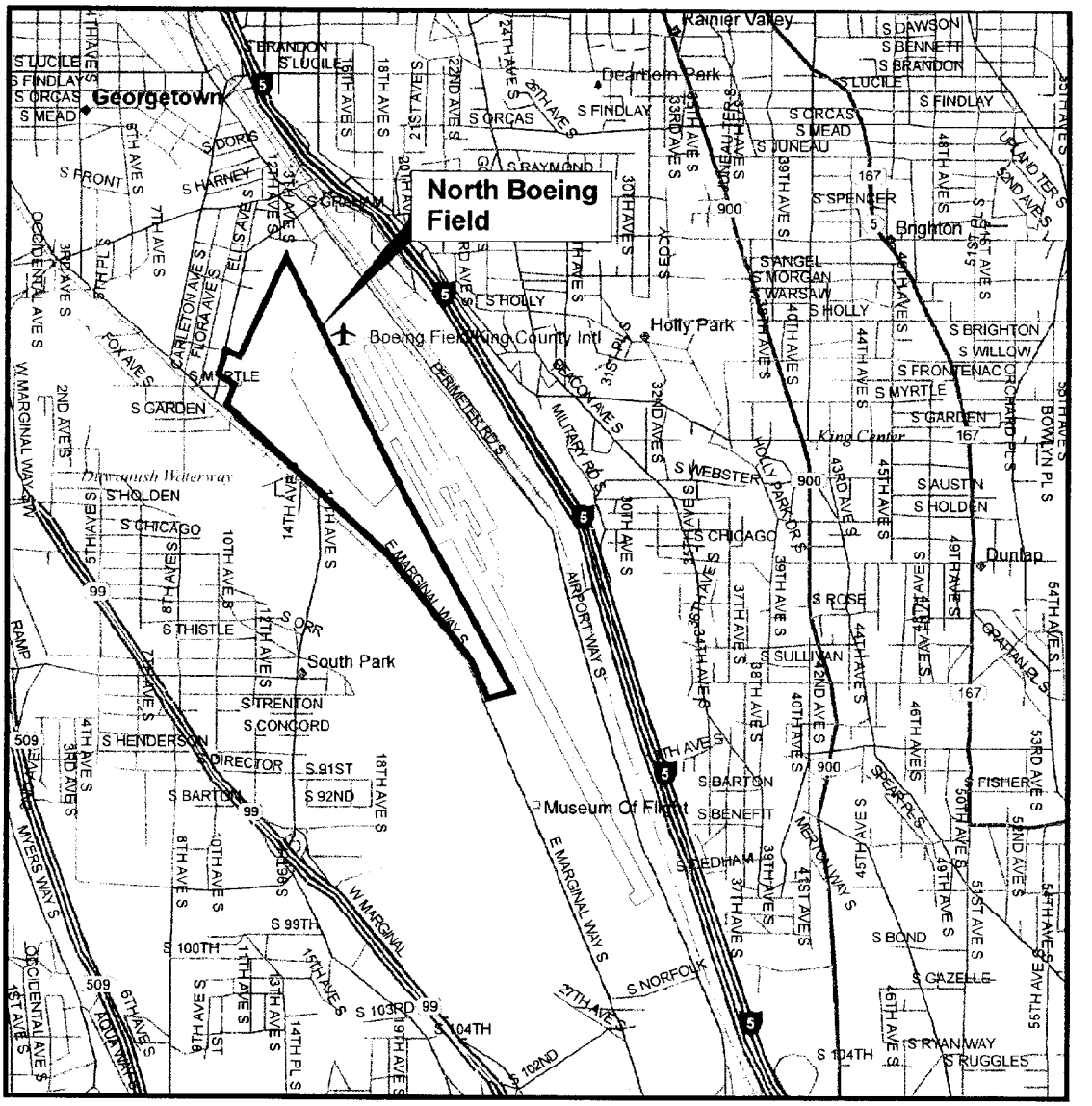

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North Boeing Field Seattle, Washington	**Vicinity Map**	Figure 1

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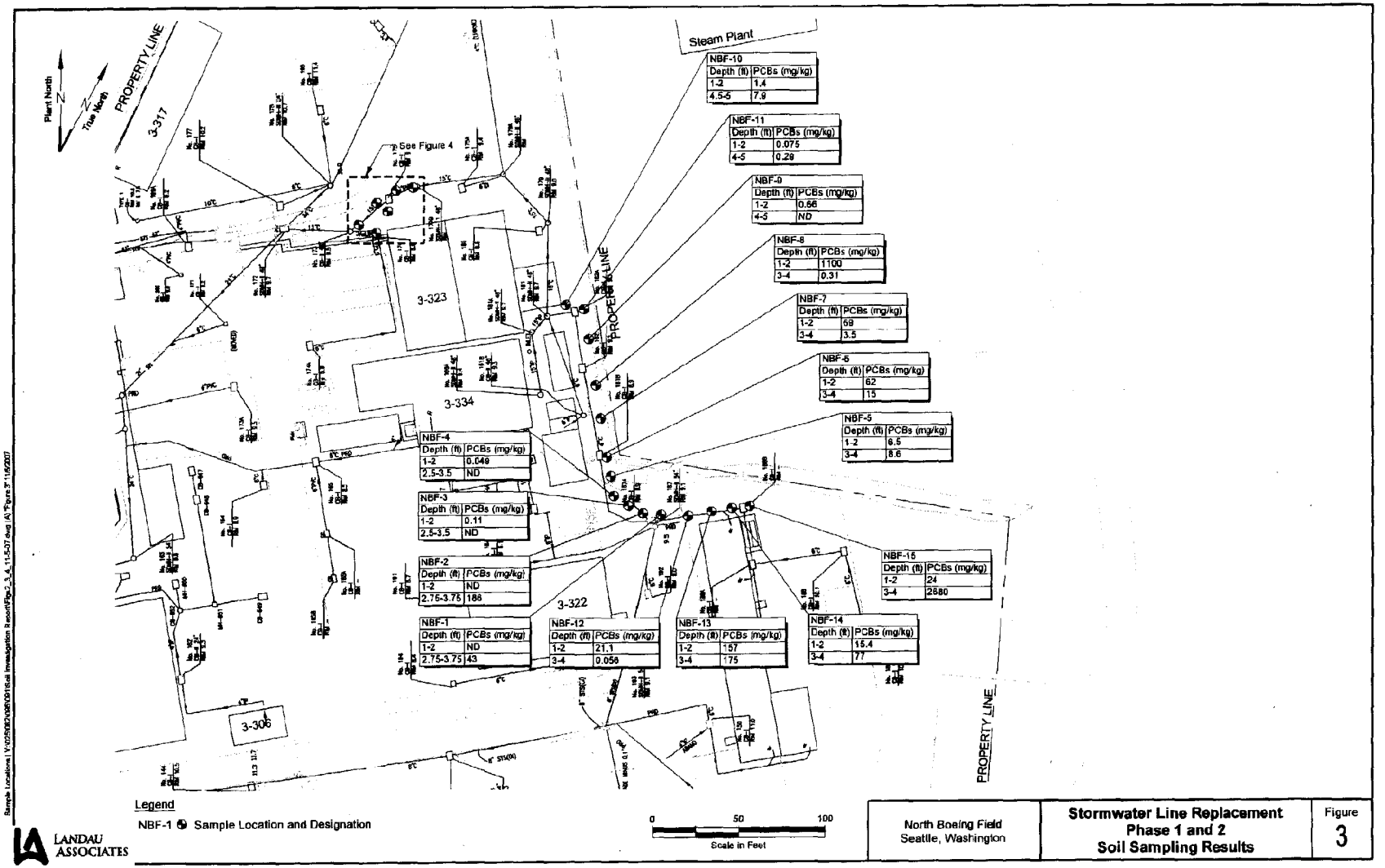

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TABLE 1
SOIL ANALYTICAL RESULTS
NORTH BOEING FIELD

Location	NBF-1	NBF-1	NBF-2	NBF-2	NBF-3	NBF-3	NBF-4	NBF-4	NBF-5	NBF-5	NBF-6
Depth (ft)	(1-2)	(2.75-3.75)	(1-2)	(2.75-3.75)	(1-2)	(2.5-3.5)	(1-2)	(2.5-3.5)	(1-2)	(3-4)	(1-2)
Lab ID	LC44A	LC44B	LC44C	LC44D	LC44E	LC44F	LC44G	LC44H	LC44I	LC44J	LC67A
Date Collected	6/7/2007	6/7/2007	6/7/2007	6/7/2007	6/7/2007	6/7/2007	6/7/2007	6/7/2007	6/7/2007	6/7/2007	6/8/2007
PCBs (mg/kg)											
Method SW8082											
Aroclor 1016	0.033 U	4.9 U	0.033 U	25 U	0.067 U	0.032 U	0.033 U	0.033 U	0.89 U	1.9 U	22 U
Aroclor 1242	0.033 U	4.9 U	0.033 U	25 U	0.067 U	0.032 U	0.033 U	0.033 U	0.89 U	1.9 U	22 U
Aroclor 1248	0.033 U	**19**	0.033 U	**88**	0.067 U	0.032 U	0.033 U	0.033 U	0.89 U	**4.3**	22 U
Aroclor 1254	0.033 U	**24**	0.033 U	**98**	0.067 U	0.032 U	0.033 U	0.033 U	**6.5**	**4.3**	**62**
Aroclor 1260	0.033 U	4.9 U	0.033 U	25 U	**0.11**	0.032 U	**0.049**	0.033 U	0.89 U	1.9 U	22 U
Aroclor 1221	0.033 U	4.9 U	0.033 U	25 U	0.067 U	0.032 U	0.033 U	0.033 U	0.89 U	1.9 U	22 U
Aroclor 1232	0.033 U	4.9 U	0.033 U	25 U	0.067 U	0.032 U	0.033 U	0.033 U	0.89 U	1.9 U	22 U
Total PCBs	0.033 U	**43**	0.033 U	**186**	**0.11**	0.032 U	**0.049**	0.033 U	**6.5**	**8.6**	**62**
NWTPH-Dx (mg/kg)											
Diesel Range Organics											
Motor Oil Range Organics											
NWTPH-G (mg/kg)											
Gasoline											

TABLE 1
SOIL ANALYTICAL RESULTS
NORTH BOEING FIELD

Location	NBF-6	NBF-7	NBF-7	NBF-8	NBF-8	NBF-9	NBF-9	NBF-10	NBF-10	NBF-11	NBF-11
Depth (ft)	(3-4)	(1-2)	(3-4)	(1-2)	(3-4)	(1-2)	(4-5)	(1-2)	(4.5-5)	(1-2)	(4-5)
Lab ID	LC87B	LC87A	LC87B	LD86A	LD86B	LE11A	LE11B	LE11C	LE11D	LE11E	LE19A
Date Collected	6/8/2007	6/12/2007	6/12/2007	6/18/2007	6/18/2007	6/19/2007	6/19/2007	6/19/2007	6/19/2007	6/19/2007	6/19/2007
PCBs (mg/kg)											
Method SW8082											
Aroclor 1016	9.5 U	8.8 U	0.072 U	44 U	0.054 U	0.2 U	0.032 U	0.4 U	3.6 U	0.032 U	0.067 U
Aroclor 1242	9.5 U	8.8 U	0.072 U	44 U	0.054 U	0.2 U	0.032 U	0.4 U	3.6 U	0.032 U	0.067 U
Aroclor 1248	11 U	8.8 U	0.072 U	44 U	0.054 U	0.2 U	0.032 U	0.4 U	3.6 U	0.032 U	**0.16**
Aroclor 1254	**15**	**69**	**3.5**	**1100**	**0.31**	**0.66**	0.032 U	**1.4**	**7.9**	**0.075**	**0.13**
Aroclor 1260	9.5 U	8.8 U	0.072 U	44 U	0.054 U	0.2 U	0.032 U	0.4 U	3.6 U	0.032 U	0.067 U
Aroclor 1221	9.5 U	8.8 U	0.072 U	44 U	0.054 U	0.2 U	0.032 U	0.4 U	3.6 U	0.032 U	0.067 U
Aroclor 1232	9.5 U	8.8 U	0.072 U	44 U	0.054 U	0.2 U	0.032 U	0.4 U	3.6 U	0.032 U	0.067 U
Total PCBs	**15**	**69**	**3.5**	**1100**	**0.31**	**0.66**	0.032 U	**1.4**	**7.9**	**0.075**	**0.29**
NWTPH-Dx (mg/kg)											
Diesel Range Organics											
Motor Oil Range Organics											
NWTPH-G (mg/kg)											
Gasoline											

TABLE 1
SOIL ANALYTICAL RESULTS
NORTH BOEING FIELD

Location	NBF-12	NBF-12	NBF-13	NBF-13	NBF-14	NBF-14	NBF-15	NBF-15	NBF-GB1	NBF-GB2	NBF-GB3
Depth (ft)	(1-2)	(3-4)	(1-2)	(3-4)	(1-2)	(3-4)	(1-2)	(3-4)	(2-3)	(6-7)	(2-3)
Lab ID	LG46B	LG46A	LG46D	LG46C	LG46F	LG46E	LG58A	LG58B	LO25A	LO25B	LO25C
Date Collected	7/9/2007	7/9/2007	7/9/2007	7/9/2007	7/9/2007	7/9/2007	7/10/2007	7/10/2007	9/6/2007	9/6/2007	9/6/2007
PCBs (mg/kg)											
Method SW8082											
Aroclor 1016	1.8 U	0.032 U	13 U	9.1 U	1.8 U	14 U	5.2 U	210 U	0.075 U	49 UJ	0.085 U
Aroclor 1242	1.8 U	0.032 U	13 U	9.1 U	1.8 U	14 U	5.2 U	210 U	0.075 U	49 UJ	0.085 U
Aroclor 1248	**12**	**0.056**	**100**	**35**	**6.7**	**40**	**14**	**1600**	0.075 U	49 UJ	**0.24**
Aroclor 1254	**9.1**	0.032 U	**57**	**140**	**6.7**	**37**	**10**	**880**	**0.59**	49 UJ	**0.3**
Aroclor 1260	1.8 U	0.032 U	13 U	9.1 U	1.8 U	14 U	5.2 U	210 U	**1.3**	49 UJ	0.085 U
Aroclor 1221	1.8 U	0.032 U	13 U	9.1 U	1.8 U	14 U	5.2 U	210 U	0.075 U	49 UJ	0.085 U
Aroclor 1232	1.8 U	0.032 U	13 U	9.1 U	1.8 U	14 U	5.2 U	210 U	0.075 U	49 UJ	0.085 U
Total PCBs	**21.1**	**0.056**	**157**	**175**	**15.4**	**77**	**24**	**2680**	**1.89**	49 UJ	**0.54**
NWTPH-Dx (mg/kg)											
Diesel Range Organics											
Motor Oil Range Organics											
NWTPH-G (mg/kg)											
Gasoline											

TABLE 1
SOIL ANALYTICAL RESULTS
NORTH BOEING FIELD

Location	NBF-GB4	NBF-GB5	NBF-GB6
Depth (ft)	(6-7)	(7-8)	(7-8)
Lab ID	LO81B	LP18B	LP18C
Date Collected	9/10/2007	9/12/2007	9/12/2007
PCBs (mg/kg)			
Method SW8082			
Aroclor 1016	0.032 U	0.033 U	0.033 U
Aroclor 1242	0.032 U	0.033 U	0.033 U
Aroclor 1248	0.032 U	0.033 U	0.033 U
Aroclor 1254	**0.046**	0.033 U	0.033 U
Aroclor 1260	0.032 U	0.033 U	0.033 U
Aroclor 1221	0.032 U	0.033 U	0.033 U
Aroclor 1232	0.032 U	0.033 U	0.033 U
Total PCBs	**0.046**	0.033 U	0.033 U
NWTPH-Dx (mg/kg)			
Diesel Range Organics	**16**	**11**	
Motor Oil Range Organics	**54**	**26**	
NWTPH-G (mg/kg)			
Gasoline	7.6 U	**12**	

ND = Not Detected.

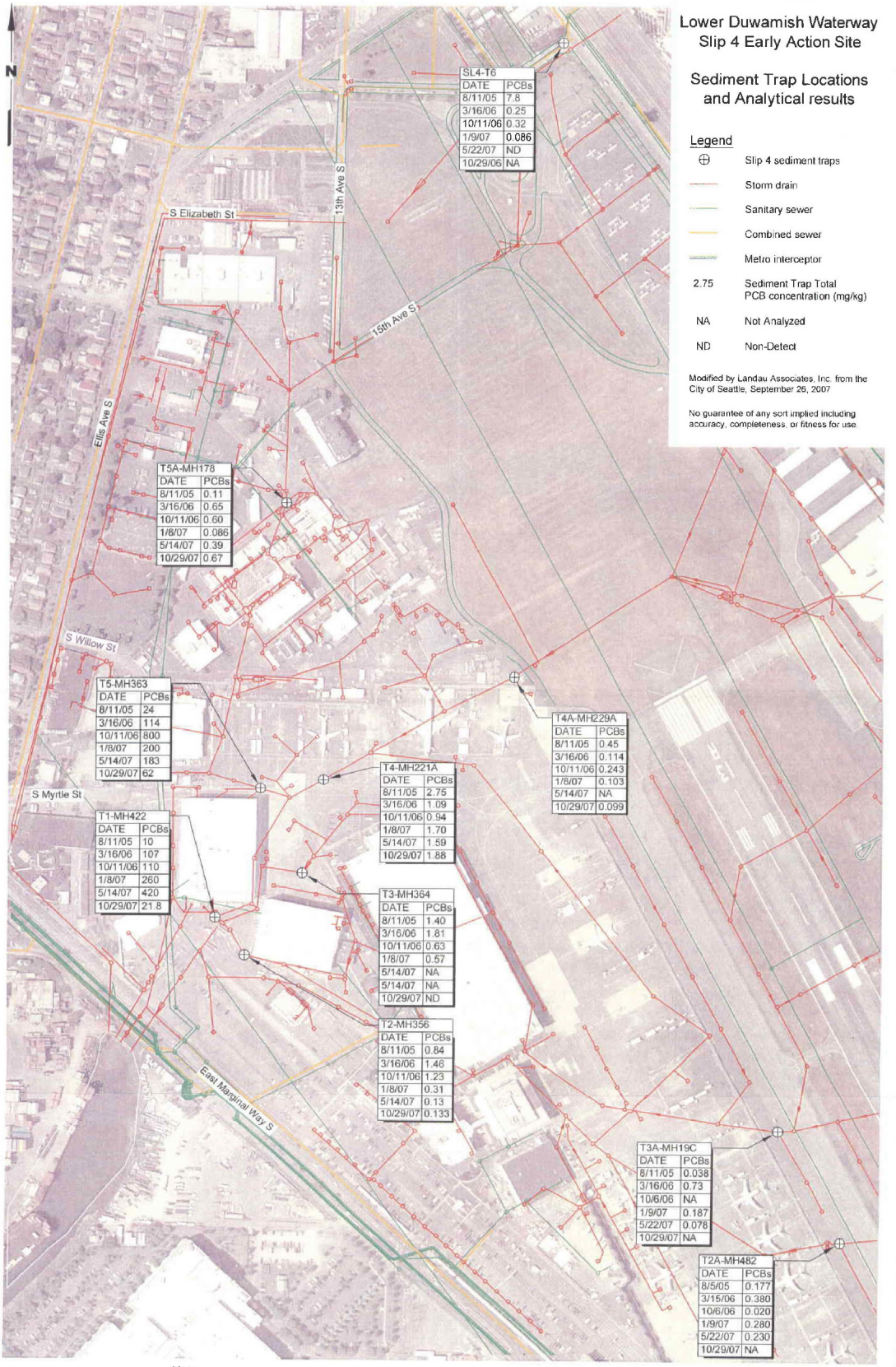
U = Indicates the compound was undetected at the reported concentration.

UJ = The analyte was not detected in the sample; the reported sample detection limit is an estimate.

Bold indicates detected compound.

TABLE 2
WATER ANALYTICAL RESULTS
NORTH BOEING FIELD

Location	NBF-GW01	NBF-GW02
Lab ID	LO81A	LP18A
Date Collected	9/10/2007	9/12/2007
PCBs (µg/L)		
Method SW8082		
Aroclor 1016	1.0 U	1.0 U
Aroclor 1242	1.0 U	1.0 U
Aroclor 1248	**1.9**	1.0 U
Aroclor 1254	1.0 U	1.0 U
Aroclor 1260	1.0 U	1.0 U
Aroclor 1221	1.0 U	1.0 U
Aroclor 1232	1.0 U	1.0 U
Total PCBs	**1.9**	1.0 U
NWTPH-DX (mg/L)		
Diesel Range Organics	0.25 U	0.25 U
Motor Oil Range Organics	0.50 U	0.50 U
NWTPH-G (mg/L)		
Gasoline	0.25 U	0.25 U



Lower Duwamish Waterway Slip 4 Early Action Site

Sediment Trap Locations and Analytical results

Legend

- Slip 4 sediment traps
- Storm drain
- Sanitary sewer
- Combined sewer
- Metro interceptor
- 2.75 — Sediment Trap Total PCB concentration (mg/kg)
- NA — Not Analyzed
- ND — Non-Detect

Modified by Landau Associates, Inc. from the City of Seattle, September 26, 2007

No guarantee of any sort implied including accuracy, completeness, or fitness for use.

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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North Boeing Field
Seattle, Washington

Sediment Trap Locations and Analytical Results

Figure 1

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